New Improvements to WinGridder: An Interactive Grid Generator For TOUGH2

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RESEARCH OBJECTIVES

The objective of this study is to enhance the WinGridder software program, which acts as a grid generator for TOUGH2, a software program used worldwide as a simulation code for multiphase, multicomponent flow and heat transfer. The main objectives are (1) to add the capability of handling a repository with multiple subregions and specified drifts, (2) to incorporate an interpolation method (instead of picking the nearest point) in calculating the geological data from a given digital geological model, (3) to add the capability of generating multiple continuum grids (MINC grids), and (4) to enhance searching and other capabilities.

APPROACH

The following approaches were adopted:

1. Taking advantage of the object-oriented-programming used in WinGridder coding, we modified the REPOSITO object to include subobjects, labeled REGIONS and DRIFTS, to represent subregions and emplacement drifts. In this way, WinGridder could handle a repository with multiple subregions, with each region having specified drifts. As a byproduct, additional grid cells representing any user-specified drifts could be embedded into an existing 3-D grid.
2. A modified bilinear interpolation method (allowing for special treatment in the neighborhood of a fault) has been implemented in the member function of the LAYER object, which calculates the geological data (e.g., layer thickness or elevation).
3. The MINC grid generated by WinGridder is similar in principle to that of the dual-continuum grid. The difference is that the matrix cell in a dual-continuum grid is split into N (a number specified by the user) connected subcells in the corresponding MINC grid. The fracture configurations (e.g., fracture porosity, fracture-matrix interface area per rock volume, fracture aperture and spacing) are provided by the user in a text file. (This functionality is only available in WinGridder V2.1 (beta)).
4. The Save Submesh functionality has been enhanced to save any user-selected subgrid as an independent grid project. Many other tools have been added.

ACCOMPLISHMENTS

WinGridder V2.0 and V2.1 (beta) have been developed, and WinGridder V2.0 has been qualified for the Yucca Mountain Project. V2.0 has been successfully used to design and generate 1-D, 2-D, and 3-D meshes for numerical modeling of flow and transport at Yucca Mountain and at the Berkeley Lab site.

SIGNIFICANCE OF FINDINGS

The main advantages of this grid-generation software are its user-friendly graphical interfaces, flexible grid-design capabilities, efficient grid generation, and powerful searching and postprocessing capability, especially for large size grids (e.g., grids composed of a million grid cells or more). This software has been increasingly applied around the world (so far, multiple users in the U.S., Asia, and Europe).

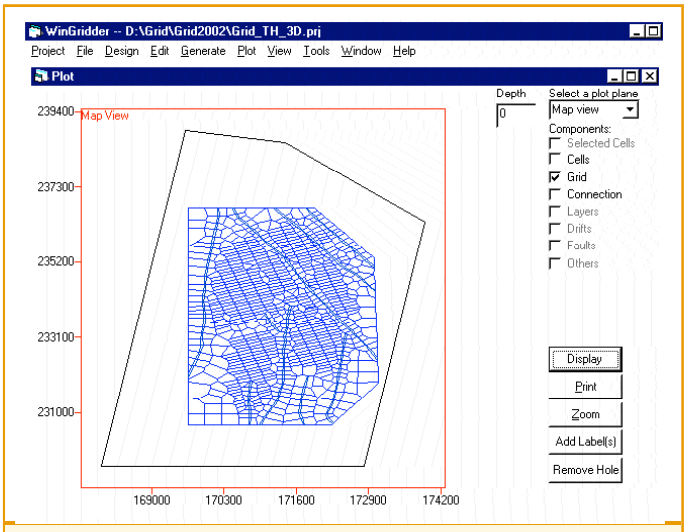

Figure 1. The main window of the WinGridder.

RELATED PUBLICATION

Pan, L., WinGridder—An interactive Grid Generator for TOUGH2. Proceedings of the TOUGH Symposium 2003. Berkeley, California, May 12–14, 2003; Berkeley Lab Report, LBNL-52422, 2003.

ACKNOWLEDGMENTS

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